Sertifikaat

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EN NYWERHEID

Certificate

REPUBLIC OF SOUTH AFRICA

PATENT OFFICE
DEPARTMENT OF TRADE AND
INDUSTRY

Hiermee word gesertifiseer that
This is to certify that

the documents annexed hereto are true copies of:

Application forms P.1, P.2, provisional specification and drawings of South African Patent Application No. 2002/5395 as originally filed in the Republic of South Africa on 05 July 2002 and post-dated to 15 August 2002 in the name of BALMORAL TECHNOLOGIES (PROPRIETARY) LIMITED for an invention entitled: "METHOD OF PRODUCING A HYDRAULIC BINDER CONTAINING PRODUCT."

Ge... PRETORIA in die Republiek van Suid-Afrika, hierdie dag van
in the Republic of South Africa, this 15th day of February 2006

Registrateur van Patente
Registrar of Patent

FORM P.2

REPUBLIC OF SOUTH AFRICA	REGISTER OF PATENTS Post-dated	PATENTS ACT, 1978

OFFICIAL APPLICATION		LODGING DATE: PROVISIONAL		ACCEPTANCE DATE	
21	01 2002/5395	22	15, 08 ~~JUL~~ 2002	47	
INTERNATIONAL CLASSIFICATION		LODGING DATE: COMPLETE		GRANTED DATE	
51		23			

FULL NAME(S) OF APPLICANT(S)/PATENTEE(S)

71 BALMORAL TECHNOLOGIES (PROPRIETARY) LIMITED

APPLICANTS SUBSTITUTED:		DATE REGISTERED
71		

ASSIGNEE(S)		DATE REGISTERED
71		

FULL NAME(S) OF INVENTOR(S)

72 SYMONS, MICHAEL WINDSOR

PRIORITY CLAIMED	COUNTRY		NUMBER		DATE	
N.B. Use International abbreviation for country (see Schedule 4)	33	NIL	31	NIL	32	NIL

TITLE OF INVENTION

54 METHOD OF PRODUCING A HYDRAULIC BINDER CONTAINING PRODUCT

ADDRESS OF APPLICANT(S)/PATENTEE(S)

BUILDING 16, CSIR CAMPUS, MEIRING NAUDE ROAD, SCIENTIA, PRETORIA, GAUTENG, SOUTH AFRICA

ADDRESS FOR SERVICE		S & F REF
74	SPOOR & FISHER, SANDTON	PA133496/P

PATENT OF ADDITION NO.		DATE OF ANY CHANGE
61		
FRESH APPLICATION BASED ON		DATE OF ANY CHANGE

SPOOR & FISHER

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

APPLICATION FOR A PATENT

AND ACKNOWLEDGEMENT OF RECEIPT
(Section 30 (1) – Regulation 22)

FORM P1

REPUBLIC OF SOUTH AFRICA
REVENUE
05.07.02
R 0060.00
HASR 711
INKOMSTE
REPUBLIEK VAN SUID AFRIKA

The granting of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate

OFFICIAL APPLICATION NO.			S & F REFERENCE
21	01	2002/5393	PA133496/P

FULL NAME(S) OF APPLICANT(S)

71	BALMORAL TECHNOLOGIES (PROPRIETARY) LIMITED

ADDRESS(ES) OF APPLICANT(S)

	BUILDING 16, CSIR CAMPUS, MEIRING NAUDE ROAD, SCIENTIA, PRETORIA, GAUTENG, SOUTH AFRICA

TITLE OF INVENTION

54	METHOD OF PRODUCING A HYDRAULIC BINDER CONTAINING PRODUCT

THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANYING FORM P.2. THE EARLIEST PRIORITY CLAIM IS:

COUNTRY: NIL NUMBER: NIL DATE: NIL

~~THIS APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION NO.~~

21	01	

~~THIS APPLICATION IS A FRESH APPLICATION IN TERMS OF SECTION 37 AND IS BASED ON APPLICATION NO.~~

21	01	

THIS APPLICATION IS ACCOMPANIED BY:

- ☒ 1. A single copy of a provisional specification of 15 pages.
- ☒ 2. Drawings of 1 sheet.
- ☐ 3. Publication particulars and abstract (Form P.8 in duplicate).
- ☐ 4. A copy of Figure of the drawings (if any) for the abstract.
- ☐ 5. Assignment of invention.
- ☐ 6. Certified priority document.
- ☐ 7. Translation of the priority document.
- ☐ 8. Assignment of priority rights.
- ☐ 9. A copy of the Form P.2 and the specification of S.A. Patent Application No .
- ☐ 10. Declaration and power of attorney on Form P.3.
- ☐ 11. Request for ante-dating on Form P.4.
- ☐ 12. Request for classification on Form P.9.
- ☒ 13. Form P.2 in duplicate.
- ☐ 14. Other.

74	ADDRESS FOR SERVICE: SPOOR & FISHER, SANDTON

Dated: 5 July 2002

AM Dye

SPOOR & FISHER
PATENT ATTORNEYS FOR THE APPLICANT(S)

REGISTRAR OF PATENTS, DESIGNS, TRADE MARKS AND COPYRIGHT
RECEIVED
15.08.2002
~~2002-07-05~~
Post-dated
REGISTRATEUR VAN PATENTE, MODELLE, HANDELSMERKE EN OUTEURSREG

REGISTRAR OF PATENTS

SPOOR & FISHER

FORM P.6

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30(1) – Regulation 27)

OFFICIAL APPLICATION NO.		
21	01	2002/5395

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22	~~5 JULY 2002~~ 15 · 08 · 2002

FULL NAMES OF APPLICANTS

71	BALMORAL TECHNOLOGIES (PROPRIETARY) LIMITED

FULL NAMES OF INVENTORS

72	SYMONS, MICHAEL WINDSOR

TITLE OF INVENTION

54	METHOD OF PRODUCING A HYDRAULIC BINDER CONTAINING PRODUCT

BACKGROUND OF THE INVENTION

This invention relates to a method of producing a product from a flexible open cell polymeric foam element and a hydraulic binder slurry, and to the product so made. The product may be for example a panel or a board or the like for use in the building industry.

Portland cement based building boards are well known. They are generally made from cement bound particle board or the like, i.e they contain lignocellulosic particles or fibres. These boards however suffer from the disadvantage that the lignocellulosic particles or fibres have a propensity to swell when water wetted and can interfere with the cure of the Portland cement. In addition, the manufacture of the boards generally includes autoclaving, which is energy intensive.

Other types of hydraulic binder based building boards include those that contain expanded minerals such as vermiculite. The method of manufacture of

such boards generally involves the use of pressure and temperature in a sophisticated production plant.

Another type of known boards are gypsum building boards which generally include the use of paper liners which are expensive and absorptive of paint.

Thus, while many types of hydraulic binder based building boards are known, they generally suffer from one or other disadvantage. There is thus a need for a new type of hydraulic binder based product.

SUMMARY OF THE INVENTION

According to a first aspect of the invention there is provided a method of producing a product from:

(a) a flexible open cell polymeric foam element; and

(b) a hydraulic binder slurry;

which includes the steps of:

(1) introducing the hydraulic binder slurry into the open cells of the foam element by compressing the foam element to exclude air from the open cells and then releasing the compression with the foam element in contact with the hydraulic binder slurry so that the hydraulic binder slurry penetrates and becomes contained in the open cells of the foam element; and

(2) allowing the hydraulic binder to set and dry to form the product.

In one embodiment of the invention, in step (1), the foam element is submerged in the hydraulic binder slurry, and while submerged, the foam element is compressed to exclude air from the open cells. The compression is then released so that the slurry penetrates and becomes contained in the open cells.

In a second embodiment of the invention, in step (1), a hydraulic binder slurry may be applied to a surface of the foam element. Then the foam element with the hydraulic binder thereon is compressed to exclude air from the open cells and then the compression is released so that the hydraulic binder slurry penetrates and becomes contained in the open cells.

This step may be repeated.

In a third embodiment of the invention, in step (1), a hydraulic binder in dry powder form is placed on the foam element, the hydraulic binder is then slurried with water, for example by spraying the water onto the hydraulic binder, and then the foam element with the hydraulic binder slurry thereon is compressed to exclude air from the open cells and then the compression is released so that the hydraulic binder slurry penetrates and becomes contained in the open cells.

The compression of the foam element in step (1) may be carried out by passing the foam element between a first roller and a surface, for example a second roller.

The method of the invention preferably includes a step, after step (1) and before step (2) of:
compressing the foam element containing the hydraulic binder slurry to remove therefrom a proportion of the hydraulic binder slurry.

This may be achieved by compressing the foam element containing the hydraulic binder slurry between a third roller and a surface, for example a fourth roller. In this way, the content of hydraulic binder slurry in the foam element may be varied in order to vary the final density of the product.

According to a second aspect of the invention there is provided a product comprising an open cell polymeric foam element containing a set hydraulic binder in the open cells. The product is preferably made by the method described above.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 is a schematic diagram of an embodiment of the method of the invention.

DESCRIPTION OF EMBODIMENTS

The first aspect of the invention is a method of producing a product from a flexible open cell polymeric foam element and a hydraulic binder slurry.

The first component is thus a flexible open cell polymeric foam element.

The preferred flexible open cell polymeric foam element is made from a polyurethane foam having a density in the range of from 7 kg/m^3 to 40 kg/m^3, more preferably from 9 kg/m^3 to 20 kg/m^3 inclusive. A particularly suitable flexible open cell polyurethane foam is one based on the combination of a toluene diisocyanate with a polyol, water, methylene chloride as a blowing agent, stannous octoate as a catalyst, and a surfactant which determines the cell size. Toluene diisocyanate is produced as two isomers, viz. 2,4-toluene diisocyanate (2,4-TDI) and 2,6-toluene diisocyanate (2,6-TDI) and is commercially available as:

greater than or equal to 99.5% 2,4-TDI;

80% 2,4-TDI and 20% 2,6-TDI which is the most commonly used product and is referred to hereinafter as TDI (80:20);

65% 2,4-TDI and 35% 2,6-TDI; and
"crude" TDI with an unidentified isomer ratio.

An example of a composition for use in making a flexible open cell polyurethane foam is as follows:

TDI (80:20)	578.7
Durapol 3000 (a polyol)	675
Water	46
Silicone surfactant (Niax L/580)	19.6
33 LV (catalyst)	1.9
Glycerine (crosslinker)	3.7
Methylene chloride (blowing agent)	166
Stannous octoate (catalyst)	2.1

All parts by weight
The result is a TDI flexible open cell medium hard polyurethane foam with a density of 10 kg/m^3.

Other suitable polymeric foams include polyester foams, polyether foams, polyurethane polyester hybrid foams, and the like.

It is important that the polymeric foam element has a good "memory" so that after it has been compressed, when the compression is released, the foam element returns to substantially its original dimensions so that the hydraulic binder slurry can fill the open cells.

It is also important that the polymeric foam element has a suitable hardness as it is required to act as a carrier for the hydraulic binder slurry and act to as a re-inforcer therefor.

As the polymeric foam element is flexible, the element may be post formed into a desired shape before the hydraulic binder hydrates and sets. The shaping of

the polymeric foam element containing the hydraulic binder slurry may take place in a mould or maybe formed between the platens of a press or the like.

Alternatively, the polymeric foam element may be shaped before it comes into contact with the hydraulic binder slurry. For example the polymeric foam element may be produced in a mould of a desired shape, e.g for the production of a fielded and planed door core, a shaped roof tile, or a board with a textured surface.

The second component is a hydraulic binder slurry.

The hydraulic binder is preferably selected from the group consisting of Portland cement, the alpha and beta hemi-hydrates of calcium sulphate, a calcium aluminate cement, magnesium oxychloride, and magnesium oxysulphate.

The hydraulic binder may be a Portland cement, preferably a rapid hardening Portland cement with a particle size of from 475 m^2/kg or finer. The Portland cement may be mixed with up to 40% by weight of an undensified silica fume with a particle size of about 20000 m^2/kg.

When the hydraulic binder is the alpha or beta hemi-hydrate of calcium sulphate, it is preferably the beta-hemi hydrate of calcium sulphate, which is preferably finely ground, having a particle size of 300 mesh which may be either synthetic or natural. This product is also referred to as gypsum.

When the hydraulic binder is Portland cement, the hydraulic binder slurry preferably contains 35 to 55 parts by weight of water to 100 parts by weight of the Portland cement. When the hydraulic binder is the beta hemi-hydrate of calcium sulphate, the hydraulic binder slurry preferably contains from 55 to 130 parts by weight of water to 100 parts by weight of the binder.

The hydraulic binder slurry may include various optional additives as follows:

1 a polyvinyl alcohol as an auxiliary binder, introduced in the water. A suitable example is Mowiol 8/88 by Clariant.

2 An acrylic emulsion, added in the water, which increases water resistance, toughness and flexural strength.

3 A super plasticiser in order to reduce the water to binder ratio at a given viscosity. A suitable example is Melment F10 by Hoechst, which is a melamine formaldehyde condensate.

4 A hydrophobic agent such as a silicone masonry water repellant. A suitable example is BS 94 by Wacker which is an anhydrous silicone based on hydrogen polysiloxane. When the hydraulic binder is gypsum, it is preferably added to the gypsum in an amount of about 0.3% by weight. Another suitable hydrophobic agent, particularly for use with Portland cement is BS 1307 by Wacker which is a silicone resin siloxane mixture which is used in an amount of about 0.4% by weight.

The retention of the hydraulic binder slurry in foam elements where the cell sizes are relatively large is a function of apparent viscosity or rheology. In order to ensure a suitable rheology, silica fume may be added to Portland cement, or suitable thickeners may be added to any of the hydraulic binders. Acrylic based thickener compounds are preferred.

The first step of the method of the invention is to introduce the hydraulic binder slurry into the open cells of the foam element by compressing the foam element to exclude air from the open cells and then releasing the compression with the foam element in contact with the hydraulic binder slurry so that the slurry penetrates and becomes contained in the open cells.

In one embodiment of the invention, the foam element is submerged in the hydraulic binder slurry and while submerged, the foam element is compressed,

whereafter the compression is released so that the slurry penetrates and becomes contained in the open cells.

In the compression stage, the air in the open cells of the foam element is forced out of the open cells. Thereafter, when the compression is released, the foam element, having a memory, returns substantially to its original size and shape, i.e the open cells open up again, allowing the hydraulic binder to penetrate and be contained in the open cells.

It is not necessary to exclude all of the air from the open cells of the foam element. Depending on the nature of the product to be manufactured, the amount of air to be excluded from the open cells can be determined.

The compression of the foam element is preferably carried out by passing the foam element between a first roller and a surface, for example a second roller.

This first embodiment of the invention is illustrated in Figure 1.

Referring to Figure 1, a flexible open cell polymeric foam element 10, which may be either a continuous sheet, or a discrete element, which may be flat or shaped, is transported on a conveyor 12 into a slurry tank 14 containing an agitator 16. The slurry tank 14 is filled with a hydraulic binder slurry. The foam element 10 is passed between two rollers 18, 20 between which the foam element 10 is compressed. On exiting the rollers 18, 20 the foam element 10 regains its original size and shape and the hydraulic binder slurry penetrates and becomes contained in the open cells of the foam element 10. The foam element 10 now containing the hydraulic binder slurry passes out of the slurry tank 14 and is passed between two rollers 22, 24. The foam element 10 containing the hydraulic binder slurry is compressed between the rollers 22, 24 to extract some of the hydraulic binder slurry therefrom. This hydraulic binder slurry is then fed back to the slurry tank 14.

The foam element 10 now containing the desired content of hydraulic binder slurry is passed onto a conveyor 26 and then through a drier 28 in which the hydraulic binder hydrates and sets and is dried. The final product 30 then exits the drier 28.

In an alternative, before the hydraulic binder in the hydraulic binder slurry hydrates and sets, the foam element containing the hydraulic binder slurry may be formed into a desired shape. For example, the foam element containing the hydraulic binder slurry may be placed onto a mould and then conformed to a shape such as a corrugated sheet or U-section or the like.

In a second embodiment of the invention, a hydraulic binder slurry may be applied to a surface of the foam element. Then the foam element with the hydraulic binder thereon is compressed to exclude air from the open cells and then the compression is released so that the hydraulic binder slurry penetrates and becomes contained in the open cells. The compression between the rollers forces penetration of the hydraulic binder slurry into the open cells of the foam element. This step may be repeated in order to ensure sufficient penetration of the hydraulic binder slurry into the open cells of the foam element.

In a third embodiment of the invention, a hydraulic binder in dry powder form may be placed on the foam element. Then, the hydraulic binder may be slurried with water. Then, the foam element with the hydraulic binder slurry thereon is compressed to exclude air from the open cells. The compression is then released so that the hydraulic binder slurry, in contact with the foam element, penetrates and becomes contained in the open cells.
The second step of the method of the invention is to allow the hydraulic binder to set, and drying to form the product.

Examples of products which may be produced by the method of the invention include the following:

Gypsum Containing Products

A product moulded on both sides, such as the core of a fielded and planed or multi panelled door, with a dry density in the range of from 250 to 400 kg/m^3 inclusive.

A product moulded to have a texture or pattern on one surface, such as an acoustic ceiling tile, with a dry density in the range of from 200 to 300 kg/m^3 inclusive.

Ceiling boards, wall boards and wall cores, particularly wall boards reinforced with an acrylic to conform to the ASTM performance standards for wall boards without paper liners, with a dry density in the range of from 400 to 600 kg/m^3 inclusive.

Thermal insulation panels with a dry density in the range of from 100 to 175 kg/m^3 inclusive and an R value of 3.2.

Portland Cement Products

Siding where the foam element has been shaped to the requisite profile to produce a product with a dry density of about 800 kg/m^3, which may then receive a pure acrylic pigmented overcoat.

Splash backs with a density of about 900 kg/m^3 and a typical thickness of about 12 mm.

Corrugated roof sheeting where the foam element containing the hydraulic binder slurry has been shaped over a former to provide a corrugated profile, the product having a dry density of about 1200 kg/m^3.

A roof tile with a dry density in the range of from 1200 to 1500 kg/m^3.

A U-section gutter, having a thickness of 10 mm and a dry density of about 1400 kg/m^3.

Another product which may be produced by the method of the invention is lightweight aggregate, formed from chipped foam particles or granules which may then be bound together by a hydraulic binder before or after setting, or by another binder after setting, and used as a castable or sprayable composition.

The foam element may be formed into particles or granules before coming into contact with the hydraulic binder slurry. Alternatively the product may be broken up after the hydraulic binder has set to give particles or granules.

The density of the product is controlled by the following variables:
the cell size of the polymeric foam element;
the water to hydraulic binder proportion by weight in excess of that required for full hydration of the hydraulic binder; and
the amount of the hydraulic binder slurry removed from the saturated polymeric foam element during the method.

Densities of from 100 to 1500 kg/m^3 are achievable with great accuracy by the method of the invention.

It is also to be noted that because the polymeric foam element has a uniformity of cell distribution, the resulting product is also uniform.

In addition, dense surface skins of hydraulic binder may easily be incorporated into a product before setting of the hydraulic binder.

The method of the invention has various advantages. Firstly, it utilises simple equipment which thus has cost implications. The method is also energy efficient. The method allows density control of the finished product over a wide range. Using the method of the invention it is possible to produce a wide variety of finished products, with a variety of shapes.

The method permits the production of products containing no lignocellulosic or other carrier fibres with their associated disadvantages.

Examples of the invention will now be given.

Example 1

An acoustic ceiling tile is made by the following method:

There is provided a 20 mm thick 10 kg/m^3 density open cell flexible TDI polyurethane foam element.

There is produced a hydraulic binder slurry containing:

Beta hemihydrate natural gypsum fine grind	1200
2% solution of Mowiol 8/88 by Clariant – polyvinyl alcohol in water solution	800
Melment F10 super plasticiser by Hoechst	10
Wacker BS15 potassium methyl siliconate	20

All parts by weight

The foam element is passed into a slurry tank containing the hydraulic binder slurry composition set above and is compressed between two rollers. On release of the compression, the hydraulic binder slurry penetrates and becomes contained in the open cells of the foam element.

The foam element containing the hydraulic binder slurry is passed out of the slurry tank and is rolled between two rollers to extract certain of the hydraulic binder slurry. The foam element containing the desired quantity of hydraulic binder slurry is then passed through a drier where the hydraulic binder sets and the product dries. Thereafter the product is cut to size to produce a ceiling tile measuring 600 x 600 x 20 mm with a dry density of 250 kg/m^3.

Example 2

A building board is made by the following method:

There is provided an 8 mm thick 14 kg/m^3 density flexible open cell TDI polyurethane foam element.

There is produced a hydraulic binder slurry containing:

Rapid hardening Portland cement	900
Silica fume undensified	100
Water	420
Acrylic emulsion	60
Melment F10 super plasticiser	10
Wacker BS1307 silicone base	6

All parts by weight

The foam element is passed into a slurry tank containing the hydraulic binder slurry composition described above. The foam element is compressed between two rollers in the slurry tank. On release of the compression, the hydraulic binder slurry penetrates and becomes contained in the open cells of the foam element.

The foam element containing the hydraulic binder slurry is passed out of the slurry tank. The Portland cement is allowed to hydrate and set, whereafter the product is dried to produce an 8 mm thick building board with a density of

900 kg/m^3. The board is easy to cut and nail, can be machined, is resistant to freeze/thaw and is cost effective.

Dated this 5th day of July 2002

AM Dye

SPOOR & FISHER
APPLICANT'S PATENT ATTORNEYS

MORAL TECHNOLOGIES (PROPRIETARY) LIMITED

OVISIONAL SPECIFICATION

2002/5395

ONE SHEET

SHEET ONE

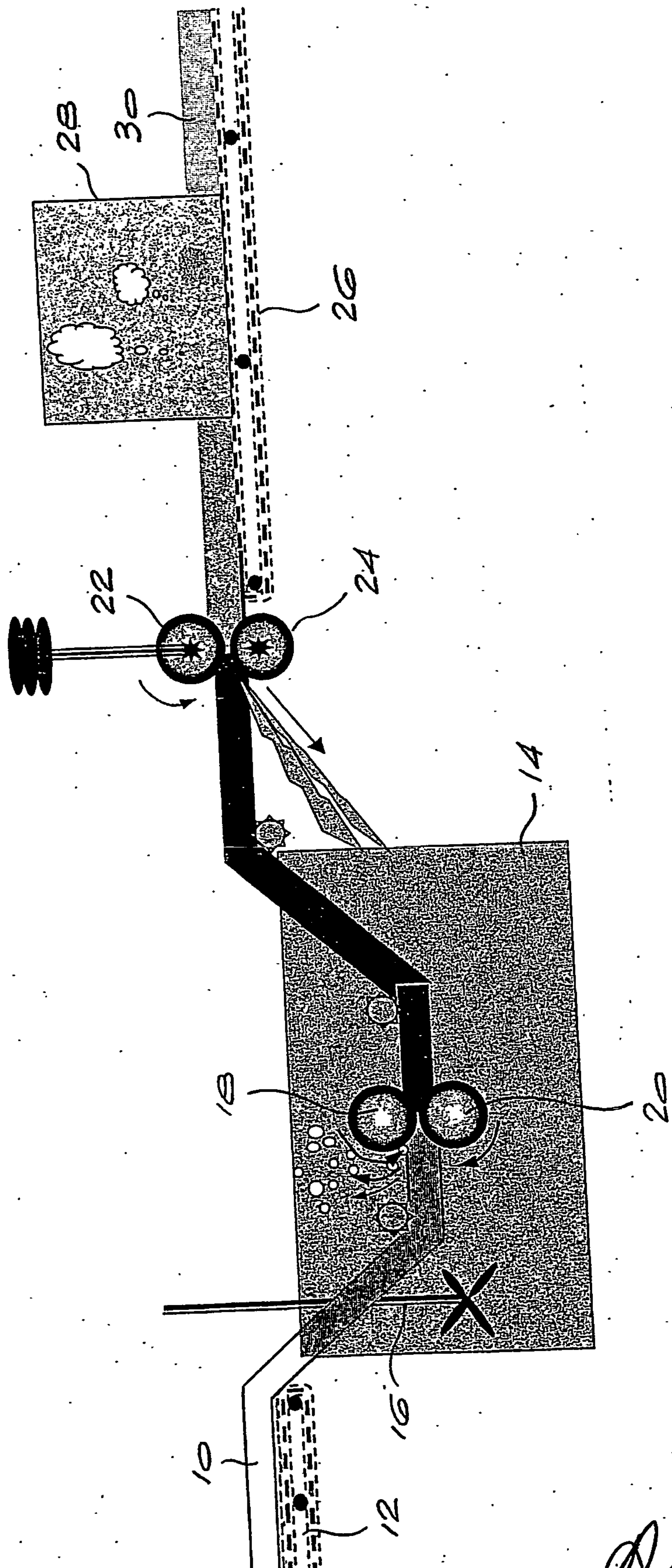

FIG 1

SPOOR & FISH

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